

Amendments to the Claims:

Claims 1-91 (canceled)

92. (currently amended) A semiconductor device ~~bonding structure, suited for~~
5 ~~bonding a first electric component and a second electric component, comprising:~~

a pad having a region exposed by an opening in a passivation layer;

a metal pillar over all of said region; ~~first electric component; and~~

a tin-containing cap over said metal pillar, wherein said tin-containing cap has a
greatest transverse dimension less than a transverse dimension of said metal pillar; ~~said~~
10 ~~cap suited for being bonded to a pad exposed by an opening in an insulation layer of said~~
~~second electric component, wherein said greatest transverse dimension of said cap is less~~
~~than a transverse dimension of said opening, wherein said cap is formed over said pillar~~
~~before said first electric component is bonded to said second electric component.~~

93. (currently amended) The semiconductor device ~~structure~~ of claim 92, wherein
15 said metal pillar comprises copper.

94. (currently amended but withdrawn) The semiconductor device ~~structure~~ of
claim 92, wherein said metal pillar comprises a tin-lead alloy.

95. (currently amended but withdrawn) The semiconductor device ~~structure~~ of
20 claim 92, wherein said metal pillar comprises gold.

96. (currently amended) The semiconductor device ~~structure~~ of claim 92, wherein
25 said metal pillar comprises a tin-silver-copper alloy.

97. (currently amended) The semiconductor device ~~structure~~ of claim 92, wherein
said metal pillar ~~cap~~ comprises an electroplated metal. ~~solder.~~

98. (currently amended but withdrawn) The semiconductor device structure of claim 92, wherein said tin-containing cap further comprises lead. ~~a tin-lead alloy.~~

5 99. (currently amended) The semiconductor device structure of claim 92, wherein said tin-containing cap further comprises bismuth. ~~tin.~~

100. (currently amended) The semiconductor device structure of claim 92, wherein said tin-containing cap comprises an electroplated metal. ~~a lead-free alloy.~~

10 101. (currently amended) The semiconductor device structure of claim 92 further comprising a conductive layer between said metal pillar and said tin-containing cap, said metal pillar having a height greater than that of said conductive layer.

15 102. (currently amended) The semiconductor device structure of claim 101, wherein said conductive layer covers part of a top surface of ~~has a transverse dimension less than said transverse dimension of said~~ metal pillar.

20 103. (currently amended) The semiconductor device structure of claim 101, wherein said conductive layer covers all of a top surface of said metal pillar. ~~has a transverse dimension greater than said greatest transverse dimension of said cap.~~

104. (currently amended) The semiconductor device structure of claim 92, wherein said tin-containing cap has a melting point lower than that of said metal pillar.

25 105. (currently amended) The semiconductor device structure of claim 92 further comprising a metal layer between said metal pillar and said a pad and between said of ~~said first electric component~~, said metal pillar having a height greater than that of said

metal layer.

106. (currently amended) The semiconductor device structure of claim 105,
wherein said metal layer comprises titanium.

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107. (currently amended) The semiconductor device structure of claim 105,
wherein said metal layer comprises tungsten.

108. (currently amended) The semiconductor device structure of claim 105,
10 wherein said metal layer comprises chromium.

109. (currently amended) The semiconductor device structure of claim 105,
wherein said metal layer comprises copper.

110. (currently amended) The semiconductor device structure of claim 105,
15 wherein said metal layer comprises nickel.

111. (currently amended) The semiconductor device structure of claim 105,
wherein said metal layer comprises cobalt.

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112. (currently amended) The semiconductor device structure of claim 105,
wherein said metal layer comprises silver.

113. (currently amended) The semiconductor device structure of claim 105,
25 wherein said metal layer comprises gold.

114. (currently amended) The semiconductor device structure of claim 105,
wherein said metal layer comprises tin.

115. (currently amended) The semiconductor device structure of claim 105, wherein said metal layer comprises vanadium.

5 116. (currently amended) The semiconductor device structure of claim 105, wherein said metal layer comprises palladium.

117. (currently amended) The semiconductor device structure of claim 105, 92, wherein said metal layer comprises a sputtered metal. first electric component
10 comprises a chip.

118. (currently amended) The semiconductor device structure of claim 92, wherein said tin-containing cap is on said metal pillar. first electric component
15 comprises a wafer.

119. (currently amended) The semiconductor device structure of claim 92, wherein said metal pillar has a height greater than that of said tin-containing cap.
20 second electric component comprises a substrate, and said insulation layer comprises a solder mask layer.

120. (currently amended) A semiconductor device bonding structure, comprising:
a pad exposed by an opening in an insulating layer;
a copper pillar over said pad; comprising copper and formed using a process
25 comprising electroplating; and

a tin-containing cap comprising tin and over said copper pillar, wherein said
tin-containing cap has a greatest transverse dimension less than that a transverse
dimension of said copper pillar and has a height less than a height of said pillar.

121. (currently amended) The semiconductor device structure of claim 120,
wherein said tin-containing cap is on said copper pillar. ~~—pillar is over a chip or wafer.~~

122. (currently amended) The semiconductor device structure of claim 121 further
5 comprising a metal layer between said copper pillar and said pad, chip or wafer, said
copper pillar having a thickness greater than that of said metal layer.

123. (currently amended) The semiconductor device structure of claim 122,
wherein said metal layer comprises titanium, ~~tungsten, chromium, copper, nickel, cobalt,~~
10 ~~silver, gold, tin, vanadium or palladium.~~

124. (currently amended but withdrawn) The semiconductor device structure of
claim 120, wherein said tin-containing cap further comprises lead. ~~a tin-lead alloy.~~

125. (currently amended) The semiconductor device structure of claim ~~122, 120,~~
15 wherein said metal layer comprises chromium. ~~said cap comprises a lead-free alloy.~~

126. (currently amended) The semiconductor device structure of claim 120 further
comprising a conductive layer between said copper pillar and said tin-containing cap, said
20 copper pillar having a height greater than that of said conductive layer.

127. (currently amended) The semiconductor device structure of claim 126,
wherein said conductive layer covers part of a top surface of ~~has a transverse dimension~~
~~less than said transverse dimension of said copper pillar.~~

25 128. (currently amended) The semiconductor device structure of claim 126,
wherein said conductive layer covers all of a top surface of said copper pillar. ~~has a~~
~~transverse dimension greater than said greatest transverse dimension of said cap.~~

129. (currently amended) The semiconductor device structure of claim 120, wherein said tin-containing cap has a melting point lower than that of said metal pillar.

5 130-150. (canceled)

151. (currently amended) A semiconductor device ~~bonding structure~~, comprising:
a pad exposed by an opening in an insulating layer;
a metal pillar over said pad, wherein said metal pillar comprises ~~comprising a~~
10 tin-silver-copper alloy; and
a tin-containing cap over said metal pillar.

152. (currently amended) The semiconductor device structure of claim 151,
wherein said tin-containing cap is on said metal pillar. ~~pillar is over a chip or wafer.~~
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153. (currently amended) The semiconductor device structure of claim 152 further
comprising a metal layer between said metal pillar and said pad, ~~chip or wafer~~, said metal
pillar having a thickness greater than that of said metal layer.

20 154. (currently amended) The semiconductor device structure of claim 153,
wherein said metal layer comprises titanium, ~~tungsten, chromium, copper, nickel, cobalt,~~
~~silver, gold, tin, vanadium or palladium.~~

25 155. (currently amended but withdrawn) The semiconductor device structure of
claim 151, wherein said tin-containing cap further comprises lead. ~~a tin-lead alloy.~~

156. (currently amended) The semiconductor device structure of claim 153, ~~151~~,
wherein said metal layer comprises chromium. ~~cap comprises a tin.~~

157. (currently amended) The semiconductor device structure of claim 153, 151, wherein said metal layer comprises copper. ~~cap comprises a lead-free alloy.~~

5 158. (currently amended) The semiconductor device structure of claim 151, wherein said tin-containing cap further comprises bismuth. ~~a tin-bismuth alloy.~~

159. (currently amended) The semiconductor device structure of claim 151 further comprising a conductive layer between said metal pillar and said tin-containing cap, said
10 metal pillar having a height greater than that of said conductive layer.

160. (currently amended) The semiconductor device structure of claim 159, wherein said conductive layer covers part of a top surface of ~~has a transverse dimension less than said transverse dimension of said~~ metal pillar.
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161. (currently amended) The semiconductor device structure of claim 159, wherein said conductive layer covers all of a top surface of said metal pillar. ~~has a transverse dimension greater than said greatest transverse dimension of said cap.~~

20 162. (currently amended) The semiconductor device structure of claim 151, wherein said tin-containing cap has a melting point lower than that of said metal pillar.

163. (new) The semiconductor device of claim 120, wherein said copper pillar is electroplated.____
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164. (new) The semiconductor device of claim 151, wherein said metal pillar comprises an electroplated metal.